BASIS FOR ELABORATION OF A CREATIVE PROCESS IN ORGANIZATIONS THAT DEVELOP TECHNOLOGICAL INNOVATION

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ABSTRACT
The really fundamental and fruitful ideas arise from a great amount of luck and unpredictable accidents [1]. But also it is certain that Creativity is not just a moment, it is a process that should be developed in logical and systematic way within organizations and it is in this creative process where the solution principles are developed to take advantage of identified opportunities, to stimulate technological innovations. The purpose of this article is to show a methodology for the systematic application of a process that uses techniques of creativity and technology watch of integrated way denominated "watch-creative process", allowing to identify solution principles, which are part of a procedure that serves as a base for the elaboration of a creative process, from the organizations who develop technological innovations, the phases proposed are: 1) Identification of the opportunity, 2) Search and processing of data and information, 3) Analysis and transformation of information in ideas, and 4) Simulation and evaluation of ideas; they have been tested experimentally and they operate in a systematic way with a general flow chart for all the Process.

Keywords: Watch-creative process, technology watch, creative techniques, solution principles, technological innovations

1 INTRODUCTION

It is necessary to propose alternative ideas to give solution to the problems or perceived necessities to develop creativity [2]. But creativity is a process that should be developed in logical and systematic way within organizations. Multiple creative techniques have been used when generating new ideas. Also watching techniques have been used, to obtain ideas through existing knowledge. This document shows a proposal methodology for the application of a "watch-creative process" this means that a process that makes use of creative techniques as of technology watch (searching, analysis, diffusion, communication and use of information to decisions making) [3] of integrated way, with the intention of identifying solution principles to push technological innovations.

2 REFERENTIAL FRAMEWORK

Schumpeter introduced in a first time a innovation concept in 1934, to emphasize the importance of technological phenomena in economic growth, under this context he defined the innovation process in three stages: invention (conceived as the generation of idea), innovation (conceived as commercialization of product derived from this idea)

and diffusion (conceived as disclose of innovation) [4]. It is from the conception of Schumpeter and until actual time that multiple models of innovation have been developed, based on the theory of *technology push* (first generation) [5], until a fifth generation in innovation process [6], that it is determined by key factors as: integration, flexibility, networks.

In all innovation processes developed historically, the departure point for its application is generation of ideas, the approach that proposes this work understood as the identification of principles of solution in the measurement in which these ideas are validated. Meanwhile, when the innovation discipline is developed in systematic way by organizations, it is important to study or analyze how to establish a process that allows identifying the solution principles that will be the departure point for the application of a process of technological innovation. Under this context to follow it is shown the methodology denominated "watch-creative process".

3 PROPOSED METHODOLOGY FOR APPLICATION OF "WATCH-CREATIVE PROCESS"

From analysis of evolution and development of innovation processes, it is proposed the methodology about the applied "watch-creative process". Figure 1, this consists of following phases: Identification of the opportunity, Search and processing of data and information, Analysis and transformation of information in ideas, and Simulation and evaluation of ideas.

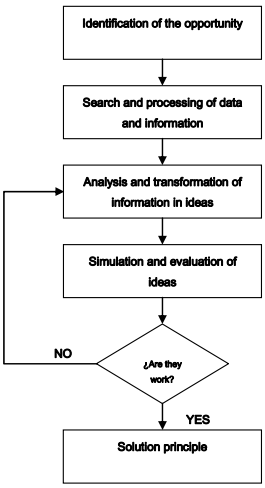

Fig .1 Relations between stages of "watch-creative process"

Phases of "watch-creative process":

- **Identification of the opportunity:** for this purpose a responsible group should be assigned, and it can focus its work to the organization through the consultation of different internal or external sources. Particularly at the idea-generation stage, companies anticipate the opportunities in the market. Thus, finding out what kind of products or services customers might need seems to be important at the very early stages of the innovation-development process [7]. On the other hand the labor to identify opportunities to innovate in the organizations might be applied systematically through the exploration of seven sources. The four first are located inside of the organization, these are: the unexpected, the incongruous, the necessity

of a process, the structure of market and the industry. The second group of sources takes place outside the organization, where they are: the demographic changes, the perception changes, and new knowledge [8].

- **Search and processing of data and information:** when it has been identified and approved by the responsible group an opportunity to innovate, the following step is to collect all data and related information. In this stage also it is necessary to assign a responsible person to searching and processing of specialized information. programs exist (Derwent [9], Espacenet [10], Tetralogie [11], etc.) that make easy this process, in addition to techniques as technology mapping [12] that provide information that enables uncertainty to be reduced. Further, it facilitates the detection of new market opportunities [13]. The development in this phase corresponds to application of activities of technology watch in face of the identified opportunity. These findings suggest that simply acquiring information from market research or technological breakthroughs would not be effective unless this information is persistently disseminated, analyzed, and implemented [14].
- **Analysis and transformation of information in ideas:** Data constitute the resources of inferior order that when they are associated within the context of identified opportunity, it produces information; this one to be analyzed in a logical sequence gives rise to strategic knowledge. In this knowledge, the responsible group can find a reference source to apply it to its case. From this consideration, the fundamental activity in this phase is to generate ideas that can be tested to guarantee that they are solution principles. It is there where the participation of all people involved is fundamental and application of creative techniques as Brainstorming [15], Lateral think [16], Mental maps [17]. In innovation projects stakeholders either have to help to determine the goals of the innovation (clients), perform tasks or set boundaries in the innovation projects (designers and decision makers), or they are affected by the innovation outcomes or by the process of innovation (passively involved) [18].
- **Simulation and evaluation of ideas:** The selected ideas in the previous phase must be tested and evaluated by an expert or a responsible group in the subject with the purpose of guaranteeing that a solution principle has been identified. These are two steps from basic cycle of design, and they are not part of the nucleus of creativity directly, constitute complementary elements of singular importance. In effect, they are those which support the validation of solution principles and, even in the case of not validating them; they contribute information about what aspects have not been covered and their causes [19].

4 SURVEY APPLICATION AND VALIDATION OF PROPOSED METHODOLOGY

During the development of this investigation, a study of transverse cut was developed, whose instrument of information collection was a survey, and it was done to professionals and managers from managerial, researching and academic (universities) fields. 20 surveys were responded of a total of 22; they were given personally and through internet on January in 2008. This survey matches in a sequential way each one of the shown phases in the proposed methodology and it allows to analyze its validation and to identify the application level of a creative process for the generation of solution principles.

5 OBTAINED RESULTS

The interviewees were classified in four groups and showed the participation level as follows: companies' researches (38%), the second group was PhD students on technological innovation projects with 31%, the third group was universities' researches with 25%, and the fourth group was technological centers' researchers with 6%.

The level of application of a creative process to identify solution principles in the organizations where the interviewees belong is shown in Figure 2.

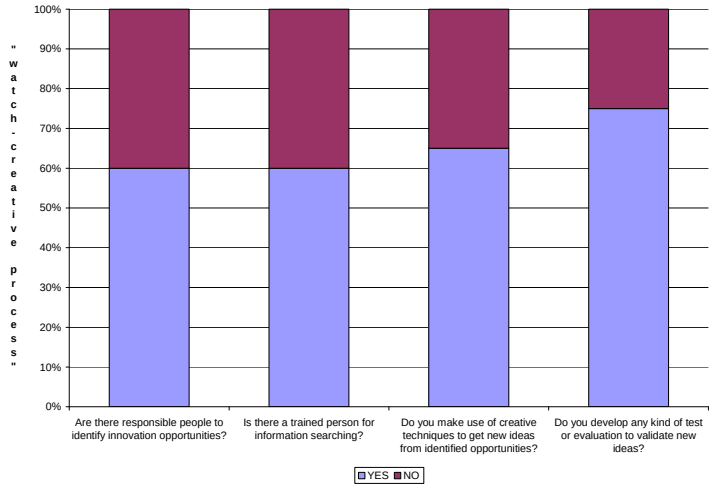

Figure 2. The application level of a creative process to identify solution principles

The results show that 60% of organizations consider necessary to assign a responsible person to identify innovation opportunities. On the other hand 60% of these organizations consider necessary to involve trained people in their creative process for information searching.

Also the results show that 65% of these organizations apply creative techniques to obtain new ideas from the identified opportunities and 75% develop any kind of test or evaluation to validate the new ideas and to guarantee that they are solution principles.

The answer about the sources that the organizations use to identify innovation opportunities was that 66% use external sources, 28% of them consult both sources, and 6% of the organizations are applied just to their internal sources to make this activity. Some of the sources used are: external; to get in touch with companies, customers, universities, suppliers, scientific articles, benchmarking and others, internal; employee's collaboration, information from laboratories, value analysis, rates of products with defects among others.

Also when it has been asked to them about the information sources mostly consulted to obtain related information to the opportunities of identified innovation the answer was: Internet (25%), specialized magazines (21%), technological centers (18%), data bases (16%), universities (11%), companies (11%), patents (2%), laboratories (2%), and professional peer contacts (2%).

The obtained results about what techniques are more used to foment creativity and to obtain new ideas in the organizations are: 31% use Brainstorming, 27% make internal meetings, 12% apply economics incentives to employees, 6% use TRIZ method, 6% to get touch with companies and researchers groups, 3% use mental maps, 3% use lateral

think, 3% use sleep-writing, 3% use Delphi method, 3% to create specific objectives and 3% to make product analysis in the market.

Finally the question about the used methods to validate the new ideas, 75% of the organizations develop some test or evaluation. Some of the techniques most utilized are: simulation and testing, prototypes and trial, specialized software, economic-technical evaluation. Other applied tests or evaluations are: scientist-technical criterion, statistical simulation, laboratory tests, selection of better projects, programs of finite elements, markets, heuristic evaluation, relation cost-profit, interactive process (put into practice, evaluation and feedback), revision of experts, meetings with projects managers, to get in touch with contracting companies and weighed criteria.

6 ANALYSIS SURVEYS' CONCLUSIONS

The professionals interviewees belong to organizations which are fundamental actors for technological development in a society of knowledge as it is Barcelona, these are: companies, universities' researches, technological centers' researchers and PhD students on technological innovation projects. Thus, these organizations permanently develop the discipline of innovation, in which the identification of solution principles of systematic way is fundamental, to facilitate this process.

However, from this investigation it has been identified that 40% of the organizations do not consider necessary to assign a responsible person to identify innovation opportunities. On the other hand 40% of them do not consider necessary to involve in their creative process trained people for information search. The results also show that 35% of these organizations do not apply creative techniques to obtain new ideas from the identified opportunities and 25% of the organizations do not develop any type of test or evaluation to validate the new ideas that guarantee that a solution principle has been found. Initially for this reason the proposed "watch-creative process", is not completely supported by the obtained results from the applied surveys to these organizations. And it demonstrates that there is no systematic application of a process for the identification of solution principles, since some organizations recognize that they do not to develop any proposed activities for this process. This allows us to validate the importance of the proposal that is made in this work and on the other hand, to know the techniques and tools that the interviewed organizations make use of, which develops creative processes; to integrate them as new obtained knowledge from the experimentation and to improve this proposal.

The results reached in the present work allow the validation of the importance of the proposed "watch-creative process" as a methodology to identify solution principles, from professionals' peer opinions who participate in technological innovations activities and they have recognized the importance of developing the creative process in a systematic way in their organizations

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